

Changes to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1-10. (Cancelled)

11. (Currently Amended) ~~The apparatus of Claim 1 further comprising:~~ An apparatus for electroplating a rotogravure cylinder out of a plating solution wherein the cylinder is connectable to a current source, the apparatus comprising:

a plating tank adapted to receive the cylinder and to contain the plating solution so that the cylinder is at least partially disposed into the plating solution;

an anode system comprising at least one non-dissolvable anode connectable to the current source and at least partially disposed within the plating solution, wherein the anode comprises a conductive core, and a surface material substantially resilient to the plating solution covering at least a portion of the conductive core; and

an ultrasonic system to introduce wave energy into the plating solution comprising at least one transducer element within the plating tank and a power generator adapted to provide electrical energy to the at least one transducer element;

a holding tank;

a circulation pump providing flow of plating solution from the holding tank to the plating tank; and

a means for maintaining a level of plating solution in the plating tank.

12. (Original) The apparatus of Claim 11 wherein the holding tank comprises a fluid heating system, a fluid cooling system, and a mixing system.

13. (Currently Amended) The apparatus of Claim 11 further comprising a filter system for filtering that filters the plating solution flowing from the holding tank to the plating tank.

14. (Original) The apparatus of Claim 11 wherein the plating tank further comprises a surface material substantially resilient to the plating solution.

15. (Original) The apparatus of Claim 11 wherein the holding tank further comprises a surface material substantially resilient to the plating solution.

16-21. (Cancelled)

22. (New) The apparatus of Claim 11 wherein the device is a valve controlled by a controller and configured to introduce a material capable of refreshing the plating solution into the holding tank.

23. (New) The apparatus of Claim 11 further comprising a sensor that provides a signal representative of a concentration of metal ions in the plating solution.

24. (New) A system for electroplating a rotogravure cylinder out of a plating solution having a concentration of metal ions wherein the cylinder is connectable to a current source, the system comprising:

an apparatus configured to plate the cylinder comprising

a non-dissolvable anode; and

a tank configured to receive the cylinder; and

a controller configured to control operation of the apparatus.

25. (New) The system of Claim 24 wherein the cylinder is plated in a first tank of the apparatus and the plating solution is refreshed in a second tank of the apparatus.

26. (New) The system of Claim 24 wherein the controller is configured to control the concentration of metal ions in the plating solution.

27. (New) The system of Claim 24 wherein the controller is configured to control a parameter relating to the ability of the apparatus to plate the cylinder.

28. (New) The system of Claim 24 further comprising a sensor coupled to the controller.

29. (New) The system of Claim 28 wherein the sensor provides a signal representative of a concentration of metal ions in a plating solution of the apparatus.

30. (New) The system of Claim 24 wherein the controller is configured to control operation of a valve.

31. (New) The system of Claim 30 wherein the valve is coupled a container configured to hold a material used to refresh the plating solution to a tank configured to hold plating solution.

32. (New) The system of Claim 24 wherein a position of the anode with respect to a cylinder is adjustable.

33. (New) The system of Claim 32 wherein the position of the anode may be adjusted to be 60 mm from the cylinder.

34. (New) The apparatus of Claim 24 further comprising at least one of a heater and a

cooler configured to maintain the plating solution at a temperature of about 25 deg C to about 35 deg C.

35. (New) The apparatus of Claim 34 wherein the apparatus is configured to plate the cylinder with copper.

36. (New) The apparatus of claim 24 further comprising at least one of a heater and a cooler configured to maintain the plating solution at a temperature of 30 deg C to 35 deg C.

37. (New) The apparatus of Claim 24 further comprising a motor that is configured to rotate the cylinder at a rate that is between about 150 to about 200 rotations per minute.

38. (New) The apparatus of Claim 24 further comprising a pump configured to pump plating solution from a second tank of the apparatus to a first tank of the apparatus.

39. (New) An apparatus for electroplating a rotogravure cylinder out of a plating solution wherein the cylinder is connectable to a current source, the apparatus comprising:

a first tank adapted to receive the rotogravure cylinder and to contain the plating solution so that the rotogravure cylinder is at least partially disposed into the plating solution;

a second tank coupled to the first tank such that plating solution may be transferred from the second tank to the first tank; and

a non-dissolvable anode connectable to the current source and configured to be at least partially disposed within the plating solution.

40. (New) The apparatus of Claim 39 further comprising at least one of a heater and a cooler configured to maintain the plating solution at a temperature of about 25 deg C to about 35 deg C.

41. (New) The apparatus of Claim 40 configured to plate the cylinder with copper.

42. (New) The apparatus of Claim 39 further comprising at least one of a heater and a cooler configured to maintain the plating solution at a temperature of 30 deg C to 35 deg C.

43. (New) The apparatus of Claim 39 wherein the plating solution is refreshed by introducing metal ions in the second tank.

44. (New) The apparatus of Claim 39 further comprising a pump configured to pump plating solution from the second tank to the first tank.

45. (New) The apparatus of Claim 44 further comprising a plurality of non-dissolvable anodes connectable to the current source, configured to be at least partially disposed within the plating solution, and configured to be disposed at one side of the cylinder when the cylinder is installed in the plating tank.

46. (New) The apparatus of Claim 44 further comprising a second pump that is configured to provide plating solution from the second tank to the first tank.

47. (New) The apparatus of Claim 39 wherein the plating solution is used to plate the cylinder with copper and the plating solution is refreshed by introducing a source of copper

ions in the second tank.

48. (New) The apparatus of Claim 40 further comprising a filter between the first tank and the second tank.

49. (New) The apparatus of Claim 48 wherein the filter is configured to filter fluids transferred from the second tank to the first tank.

50. (New) The apparatus of Claim 39 further comprising a feeder that provides copper oxide into the second tank.

51. (New) The apparatus of Claim 50 wherein the feeder is automated.

52. (New) The apparatus of Claim 39 further comprising a sensor configured to provide a signal representative of the condition of the apparatus.

53. (New) The apparatus of Claim 52 wherein the sensor is configured to provide a signal representative of a concentration of metal ions in the plating solution.

54. (New) The apparatus of Claim 53 further comprising a controller coupled to the sensor and configured to provide a second signal, based on the first signal, representative of a concentration of metal ions in the plating solution meets a criteria.

55. (New) The apparatus of Claim 54 further comprising a volumetric feeder that introduces metal ions to the plating solution based on the second signal.

56. (New) The apparatus of Claim 55 wherein the plating solution is used to plate the cylinder with copper.

57. (New) The apparatus of Claim 39 wherein a position of the anode with respect to a cylinder is adjustable.

58. (New) The apparatus of Claim 57 wherein the position of the anode may be adjusted to be 60 mm from the cylinder.

59. (New) The apparatus of Claim 57 wherein the position of the anode may be adjusted to be 80 mm from the cylinder.

60. (New) The apparatus of Claim 39 wherein the anode is configured to be capable of

carrying a current density of 12 amperes per square inch.

61. (New) The apparatus of Claim 60 configured to chrome plate the cylinder.

62. (New) The apparatus of Claim 39 further comprising a container configured to contain a substance capable of refreshing the plating solution.

63. (New) The apparatus of Claim 62 wherein the substance is used to refresh the plating solution when a concentration of the plating solution meets a criteria.

64. (New) The apparatus of Claim 63 wherein the criteria is a threshold value.

65. (New) The apparatus of Claim 39 further comprising a motor configured to rotate the cylinder at a selected rate that is between about 120 to about 220 rotations per minute.

66. (New) An apparatus for electroplating a rotogravure cylinder out of a plating solution wherein the cylinder is connectable to a current source, the apparatus comprising:

a tank adapted to receive the rotogravure cylinder and to contain the plating solution so that the rotogravure cylinder is at least partially disposed into the plating solution;

a non-dissolvable anode connectable to the current source and configured to be at least partially disposed within the plating solution in the first section; and

a source fluidly coupled to the tank and configured to receive a material that refreshes the plating solution.

67. (New) The apparatus of Claim 66 further comprising a spray bar configured to apply fluid to the non-dissolvable anode.

68. (New) The apparatus of Claim 67 wherein the spray bar applies plating solution to the non-dissolvable anode.

69. (New) The apparatus of Claim 66 further comprising a filter between the first section and the second section.

70. (New) The apparatus of Claim 69 further comprising a third section fluidly coupled to the first section and the second section, wherein the third section is between the first section and the second section and the filter is between the second section and the third section.

71. (New) The apparatus of Claim 66 further comprising a pump configured to pump plating solution from the second section to the first section.

72. (New) The apparatus of Claim 66 wherein the first section is not configured to receive the material.

73. (New) The apparatus of Claim 66 wherein the source is a second tank.

74. (New) The apparatus of Claim 66 further comprising a container configured to contain the material used to refresh the plating solution.

75. (New) An apparatus for electrically deplating a rotogravure cylinder of a plated material, the rotogravure cylinder coupled to a power source, the apparatus comprising:

a first tank adapted to receive the rotogravure cylinder and to contain a plating solution so that the rotogravure cylinder is at least partially disposed into the plating solution;

an electrical connector coupled to the power source and configured such that the plated material serves as an anode; and

a cathode configured to be at least partially disposed within the plating solution comprising a material that is non-dissolvable in the plating solution.

76. (New) The apparatus of Claim 75, wherein a second plated material is plated to the cathode when the rotogravure cylinder is deplated, and the cathode is formed such that after the cylinder has been deplated, the second plated material may be removed from the cathode by deplating the cathode without substantially deteriorating the cathode.

77. (New) The apparatus of Claim 75, wherein the material of the cathode that is exposed to the plating solution and is non-dissolvable in the plating solution is formed as a layer between the plating solution and a conductive core formed from a material different than the material of the cathode that is exposed to the plating solution and is non-dissolvable in the plating solution.

78. (New) The apparatus of Claim 75, wherein the cathode is not configured to have a material exposed to the plating solution that is dissolvable in the plating solution.

79. (New) The apparatus of Claim 78, wherein the second plated material is a same type of material as the plated material.

80. (New) An apparatus for electroplating a rotogravure cylinder out of a plating solution wherein the cylinder is connectable to a current source, the apparatus comprising:

a tank adapted to receive the rotogravure cylinder and to contain the plating solution so that the rotogravure cylinder is at least partially disposed into the plating solution; and

a plurality of non-dissolvable anodes connectable to the current source, configured to be at least partially disposed within the plating solution, and configured to be disposed at one side of the cylinder when the cylinder is installed in the plating tank.

81. (New) The apparatus of Claim 80 wherein the plurality of non-dissolvable anodes are disposed at one side wall of the plating tank.

82. (New) The apparatus of Claim 80 wherein the plurality non-dissolvable anodes are configured to extend partially around the cylinder.

83. (New) The apparatus of Claim 80 wherein the plurality of non-dissolvable anodes are disposed beneath the cylinder

84. (New) The apparatus of Claim 80 wherein the plurality of non-dissolvable anodes are configured to be disposed at both sides of the cylinder.

85. (New) The apparatus of Claim 80 further comprising a rail extending parallel to an axis of the cylinder, wherein the plurality of non-dissolvable anodes are adjacent to the rail.

86. (New) The apparatus of Claim 80 wherein each of the plurality of non-dissolvable anodes are at least partially disposed on a same side of the cylinder.

87. (New) The apparatus of Claim 80 wherein the plurality of non-dissolvable anodes are coupled to a current carrying rail.

88. (New) The apparatus of Claim 87 wherein the plurality of non-dissolvable anodes are connected to the current carrying rail by fasteners comprising a material that is resilient to being dissolved in the plating solution.

89. (New) The apparatus of Claim 80 wherein the plurality of non-dissolvable anodes comprises at least four non-dissolvable anodes.

90. (New) The apparatus of Claim 80 wherein a space exists between the at least two non-dissolvable anodes located at least partially on a same side of the plane.

91. (New) The apparatus of Claim 80, further comprising

a second plurality of non-dissolvable anodes configured to be at least partially disposed within the plating solution;

wherein the second plurality of non-dissolvable anodes are located on an opposite side of the cylinder from the first plurality of non-dissolvable anodes.

92. (New) The apparatus of Claim 80 wherein the at least two non-dissolvable anodes located at least partially on a same side of the plane are located on only one side of the plane.

93. (New) The apparatus of Claim 80 wherein the at least two non-dissolvable anodes located at least partially on a same side of the plane are configured to be about equidistant from the cylinder.

94. (New) An apparatus for electroplating a rotogravure cylinder out of a plating solution wherein the cylinder is connectable to a current source, the apparatus comprising:

 a tank adapted to receive the rotogravure cylinder and to contain the plating solution so that the rotogravure cylinder is at least partially disposed into the plating solution; and

 a plurality of non-dissolvable anodes connectable to the current source, configured to be at least partially disposed within the plating solution;

 wherein a plane extends along an axis of rotation of the rotogravure cylinder perpendicular to a surface of the plating solution; and

 wherein the plurality of non-dissolvable anodes comprises at least two non-dissolvable anodes located at least partially on a same side of the plane.

95. (New) The apparatus of Claim 94 wherein the plurality of non-dissolvable anodes comprises at least four non-dissolvable anodes.

96. (New) The apparatus of Claim 94 wherein a space exists between the at least two non-dissolvable anodes located at least partially on a same side of the plane.

97. (New) The apparatus of Claim 94, further comprising

 a second plurality of non-dissolvable anodes configured to be at least partially disposed within the plating solution;

 wherein the second plurality of non-dissolvable anodes are located on an opposite side of the plane from the first plurality of non-dissolvable anodes.